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### Summary Comment

James Tobin

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**COWLES FOUNDATION FOR RESEARCH IN ECONOMICS**

**AT YALE UNIVERSITY**

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**SUMMARY COMMENT**

**James Tobin**

**September 23, 1971**

Summary Comment

James Tobin

I will try to view the conference from the perspective of a general economist interested in macro-economics and in stabilization policy, with particular reference to the problems of unemployment and inflation currently afflicting the United States and other industrial countries. Suppose that such an economist attended the conference hoping to distil from the papers a simple working model of wage and price determination summarizing the conventional wisdom of the assembled experts. Recognizing that much of what he would hear and read would be empirical econometric results, he would want to observe both the theoretical models with which the investigators approached their data and their numerical results. What would he write down, or tell his class, or report to his policymaking superiors, on his return?

I think he would be able to place his findings in the following framework:

Price Adjustment Equation

$$(1) \quad g_p - \alpha_{12}g_w = -\alpha_{13}\gamma + \alpha_{14}g_p + f(u - u^e)$$

Here  $p$  is the price level;  $w$  is the money wage rate;  $p$  is the rental cost of capital services;  $g_x$  denotes the geometric rate of growth of any variable  $x$ ,  $\frac{\Delta x}{x}$ ;  $\gamma$  is the trend rate of growth of productivity;  $u$  is the actual unemployment rate and  $u^e$  its expected normal or average value; the  $\alpha$ 's are non-negative constants, and  $f$  a function with  $f(0) = 0$  and the sign of the derivative  $f'$  to be determined. The aggregate unemployment rate enters the relationship as a surrogate for the general pressure of demand on available resources. The equation applies to a self-contained closed economy, ignoring for simplicity and brevity the costs of materials imported from abroad or from other sectors, costs which naturally figure in the equations for industries and for open economies reported at the conference. In this summary I also ignore short lags in the adjustment of prices to their determinants.

#### Wage Adjustment Equation

$$(2) \quad -\alpha_{21}g_p^e + g_w = \alpha_{23}\gamma + h(u, \dot{u})$$

Here  $g_p^e$  represents "expected" price inflation, and  $h$  is a function of the unemployment rate and its rate of change with both partial derivatives negative.

Price Expectation Adjustment

$$(3) \quad s_p^e(t) = \sum_{i=1}^{\infty} \alpha_{3i} s_p(t-i)$$

$$\text{where } \sum_i \alpha_{3i} = 1, \alpha_{3i} \geq 0 \text{ all } i$$

Normal Utilization Adjustment

$$(4) \quad u^e(t) = \sum_{i=1}^{\infty} \alpha_{4i} u(t-i)$$

$$\text{where } \sum_i \alpha_{4i} = 1, \alpha_{4i} > 0 \text{ all } i.$$

These four equations are a subsystem of a complete model, capable of determining prices, price expectations, and wages, given an initial price history. Unemployment, past and present, and rental cost of capital can be taken as exogenous to the subsystem.

In a complete system, of course, unemployment and the costs of capital are endogenous and are indeed structurally related to prices and price expectations through relationships other than those of the subsystem. But it is at least conceivable that these feedbacks are cancelled by policymakers with the wisdom and determination to achieve an unemployment series of their own choosing. Even if this is not so, the subsystem is worth exploring for its own sake. That was the purpose of the conference.

Combining (1) and (2) gives the short-run Phillips curve for price inflation.

### Short-run Phillips Curve for Price Inflation

$$(5) \quad \dot{g}_p = \alpha_{12}\alpha_{21}g_p^e + (\alpha_{12}\alpha_{23} - \alpha_{13})\gamma + \alpha_{14}g_o + f(u - u^e) + \alpha_{12}h(u, \dot{u}), \text{ or}$$

$$(5a) \quad g_p - g_p^e = (\alpha_{12}\alpha_{21} - 1)g_p^e + (\alpha_{12}\alpha_{22} - \alpha_{13})\gamma + \alpha_{14}g_o + f(u - u^e) + \alpha_{12}h(u, \dot{u}).$$

A long-run equilibrium solution of the subsystem, if one exists, would consist of those stationary values  $g_p^*$ ,  $g_v^*$ , and  $g_p^{e*}$  corresponding to a stationary unemployment series  $u^*$  with capital cost constant ( $g_o = 0$ ) or otherwise specified. We can then ask the "comparative statics" question how the equilibrium rates of price and wage change depend on the value of  $u^*$ . In such an equilibrium  $\dot{u}^* = u^*$ ,  $\dot{u} = 0$ . Also, expected and actual inflation are the same, and their common value is:

### Long-run Phillips Curve for Price Inflation

$$(5) \quad g_p^* = g_p^{e*} = \frac{(\alpha_{12}\alpha_{22} - \alpha_{13})\gamma + \alpha_{14}g_o + \alpha_{12}h(u, 0)}{1 - \alpha_{12}\alpha_{21}}$$

From (5a) it is clear that such an equilibrium exists and is stable only if  $\alpha_{12}\alpha_{21} < 1$ . If  $\alpha_{12}\alpha_{21} > 1$ , any gap between actual and expected inflation, for constant  $u$ , will get larger rather than smaller. For example, a positive gap between actual and expected inflation will pull up the rate of expected inflation, but will accelerate actual wage and price inflation even more.

If  $\alpha_{12}\alpha_{21} = 1$ , there is no equilibrium. The long-run Phillips curve is vertical. The value of  $u$ , call it  $u_n$ , which satisfies

$$(7) \quad (\alpha_{12}\alpha_{22} - \alpha_{13})\gamma + \alpha_{14}g_p + \alpha_{12}h(u_n, 0) = 0$$

is the natural rate of unemployment. According to (5a), at  $u_n$ ,  $\pi_p = \pi_p^e$ , and therefore  $g_p$  and  $g_p^e$  can be constant. But this can be true at any rate of inflation or deflation. If  $u$  is steadily smaller than  $u_n$ , equation (5a) says that actual inflation  $g_p$  is always greater than expected inflation  $g_p^e$ . The gap never diminishes: the speed of inflation is always increasing. Similarly, a steady rate of unemployment above the natural rate means ever accelerating deflation.

One natural specification, discussed further below, is that:

(a)  $\alpha_{12} = \alpha_{13}$ : changes in money wages and in labor productivity have the same effect on prices, namely the elasticity of output with respect to labor input.

(b)  $\alpha_{14} = 1 - \alpha_{12}$ : changes in rental costs of capital services affect prices by the elasticity of output with respect to capital, which under constant returns to scale is the complement of the labor elasticity  $\alpha_{12}$ .

(c)  $g_p = g_p^*$ : at given rates of interest and depreciation, rental costs move with capital goods prices, therefore with general prices in a one-sector model.

With these assumptions, (6) simplifies to:

$$(6a) \quad g_p^* = g_p^{c*} = \frac{(\alpha_{22} - 1)\gamma + h(u, 0)}{1 - \alpha_{21}}$$

The crucial parameter, on which the existence of a long-run trade off depends, is simply  $\alpha_{21}$ . If  $\alpha_{21} = 1$ , the natural rate of unemployment is given by:

$$(7a) \quad (\alpha_{22} - 1)\gamma + h(u_n, 0) = 0.$$

I turn now to what the conference had to say about wage-price equations and their parameters.

#### The Price Adjustment Equation.

In a sense structural equation (1) was the major business of the conference. Four papers (Hymans, Klein, de Manil and Enzler, Hirsch) described the aggregate price equations of various econometric models of the U. S. economy, one paper (Bodkin) covered models of the Canadian economy, and one (Ball and Ruffin) tried a uniform price equation on fourteen countries. In addition, two papers (Feldstein and Wyss, Heien and Popkin) presented disaggregated sectoral price equations. With the help of Professor Nordhaus's lucid and comprehensive introductory paper, the reader can place these contributions in the perspective of previous theoretical and empirical results.

I cannot hope to do justice to this wealth of material. I will mention major points of consensus and controversy, and then point out some implications for policy.



1. The conference papers give no reason to doubt that changes in input prices and productivity have symmetrical effect on output prices. In terms of equation (1),  $\alpha_{12}$  and  $\alpha_{13}$  are equal. This is taken for granted in a number of specifications, where wage rates and productivity are combined into unit labor cost. (Klein, Hirsch, Hyman) Ball and Duffy test the hypothesis and find no reason to reject it, especially when they distinguish permanent and transitory productivity movements.

2. The evidence is that prices move with unit labor costs at standard rates of output and capacity utilization, i.e. for  $u = u^e$  in equation (1). The parameter  $\gamma$  in equation (1) represents the normal productivity trend rather than actual period-to-period productivity movement, which also reflects changes in employment and output during cyclical swings in demand and utilization. These cyclical cost movements are among the possible determinants of price summarized in the term  $f(u - u^e)$ , but they are not easy to disentangle from other cyclical influences.

In some econometric equations (de Menil-Enzler, Eckstein-Wyss, Meilen-Popkin) productivity change is simply represented by a trend, and actual productivity is never explicitly introduced. In others (Hyman, Hirsch) the standard productivity trend is calculated from a weighted average of past productivity. Hirsch uses both actual and trend productivity and is led to assign major weight to the latter. Ball and Duffy rely on actual labor cost in the first instance and then find their  $Z$  variable, which allows for deviations of productivity

from trend, to be a highly significant correction. Klein's Wharton Model now uses actual labor costs but is shifting to normal costs.

One asymmetry in the calculation of normal costs should be noted. In the calculation of the costs that move prices, the consensus is to smooth productivity changes but not to smooth wage rates. Current wage rates are taken as permanent, and combined with trend productivity.

3. The central estimate of  $\alpha_{12}$  and  $\alpha_{13}$  is one. That is, prices move in proportion to standard unit labor costs, whose rate of change is  $\dot{g}_w - Y$ . This is specified in the most successful U. S. model equation, for the FMP model (de Menil-Enzler), and in the OBE model (Hirsch). In the Michigan model (Hymans) labor costs appear to be incompletely passed on, an apparent misspecification that was costly in the 1965-69 simulation contest.

Ball and Duffy (see their Table 3) get an unconstrained estimate virtually equal to one for the United States. Their results for most other countries fall short of one, but this is to be expected for open economies. If Ball and Duffy used a trade matrix to close their 14-nation economy, it would be surprising if prices everywhere did not reflect completely international changes in wage costs. In their industry price equations Eckstein and Wyss find the coefficient on wages generally higher, and the coefficient on other input prices lower, than would be consistent with 100% pass-through of costs. They attribute this to deficiencies in their input price indexes, such that wages act as a proxy for other costs.

4. Even in a closed economy there are capital costs as well as labor costs. Nordhaus points out that in theory the long run elasticity of price with respect to labor cost should not be unity but the elasticity of output with respect to labor, probably .65 - .75. In equation (1) he would expect  $\alpha_{12} + \alpha_{14}$  to equal one, while each of them is less than one. In view of his observation, how can the assumptions and finding described in the previous section be justified?

One approach, already outlined above in derivation of equations (6a) and (7a), is that of de Menil and Enzler. The rental cost of capital  $p$  is  $(r + \delta)q$  where  $r$  is the appropriate nominal interest rate,  $\delta$  the depreciation rate, and  $q$  the price of capital goods. If  $r$  and  $\delta$  are constant and  $q$  moves with labor costs  $(g_v - \gamma)$ , then  $\alpha_{14}$  will be picked up in the coefficient of wage change and productivity trend. This is what would happen along a balanced growth path, with a constant capital-output ratio. To apply it to other situations, however, de Menil and Enzler must assume that in short-run pricing firms ignore changes in capital costs.

Marshall tells us that in the short run prices are related to marginal variable costs, a doctrine that we could amend, in the spirit of modern price theory, to refer to standard variable costs. If the quasi-rents earned in the short-run diverge from long-run capital costs, there will be adjustments. But they will be long-run output

adjustments, by the slow processes of investment and disinvestment, rather than direct and immediate price adjustments. In the end Nordhaus's equilibrium conditions will hold, but it is neither necessary nor plausible to carry them in price adjustment equations.

According to Eckstein and Wyss, interest rates enter prices directly only in three pathologically concentrated industries. Heien and Popkin estimate what they call "neoclassical" price equations to compare with their "standard" equations. What they mean by "neoclassical" is that price always moves with long-run marginal cost, although it seems to me that neoclassical theory can perfectly well accommodate Marshallian price, output, and investment adjustments to disequilibrium. In any case their neoclassical equations yield mostly one's for wage rate elasticities and contain only a few significant coefficients for capital costs, mostly for regulated industries.

Price economics makes strange bedfellows, and the notion that interest rates are directly marked up in prices finds support both in literal adherents of neoclassical competitive theory and in Galbraithians who regard oligopoly as the predominant mode and U. S. Steel as a typical price-maker. But the conference provided little comfort for those who complain that restrictive monetary policy is directly inflationary.

5. Equation (1) with  $\alpha_{12} = \alpha_{13} = 1$  is consistent with the theory that as a strong first approximation prices are determined by variable costs. This is true in competitive industries where

firms lack the power to do otherwise. In non-competitive industries prices appear to be a percentage mark-up over variable cost at normal operating rates. Indeed prices are set primarily on this basis no matter how far or in which direction actual operating rates deviate from normal. The amount of the mark-up presumably maximizes profits at the expected average operating rate, for which the capacity is designed.

Why are prices set for this level of demand even when actual demand is larger or smaller? The behavior evidently reflects monopolistic and oligopolistic calculations that long-run profits are not served by demand-related price adjustments. In an oligopoly, if a firm cuts prices to try to sustain sales in the face of declining demand, how do the rivals know that the firm is not cutting prices to capture a larger share of the market? The tacit collusion against price warfare on which oligopoly is based is a fragile structure. It can withstand price changes that are easily seen to be cost-related, but it may be destroyed by other price movements. Moreover, both monopoly and oligopoly covet long-term customer relationships which may be undermined by frequent demand-related price adjustments.

6. The term  $f(u - u^e)$  in equation (1) allows for some competitive deviation from the standard pricing practice just described, -- that is for some price adjustments up or down when demand and utilization are greater or smaller than "normal." If these adjustments are demand-related  $f'$  will be negative. A modest effect of demand

pressure is estimated in the aggregate price equations of the econometric models presented at the conference. Demand pressure is variously represented, -- by capacity utilization, unfilled orders, percentage change in sales or shipments. In the disaggregated price equations for two-digit industries presented by Eckstein and Wyss, demand pressure is represented by capacity utilization and changes in shipments. Demand effects are significant in 11 of the 16 industries studied.

On the other hand, the variable  $u-u^e$  is associated with variables which might work the opposite way. In many industries average productivity moves inversely with utilization, at least over a wide range. Basing mark-ups on actual unit labor costs rather than unit labor costs at normal operating levels would contribute to a positive  $f'$ . This inverse relation of price to utilization would be even stronger if mark-ups were based on per unit full costs. The extreme is what Eckstein and Wyss call profit-preserving pricing, or target-return pricing related to actual costs. Some of us would call it the "Blough effect" in honor of the steel companies' claim that prices must be raised at 60% operating rates in order to restore normal profits. Anyway Eckstein and Wyss detected this behavior in only three of their cases. And in general inverse price-utilization relations seem to be weak or nonexistent in the econometric results. To the extent that utilization rates affect percentage mark-ups, demand pressure variables dominate and mark-ups are wider

the higher the rate of utilization.

The price equations of the conference suggest a number of conclusions related to current controversies about inflation and inflation policy:

Price-setting behavior is consistent with the Phillips curve model. Some economists -- Harrod, Keyserling -- have alleged that inflation is inversely, rather than directly, related to utilization. They rely on the observation that average costs, variable and total, decline with utilization in many branches of industry. The evidence in the conference papers is that this cost behavior, however prevalent it may be, is not reflected in pricing. Indeed the opposite is true: demand-induced mark-up behavior adds to the slope of the short-run Phillips curve ( $f'$  is negative).

Price-setting behavior is neutral so far as the long-run trade-off between inflation and unemployment is concerned. This follows from the finding that  $\alpha_{12}$  is 1 or the equivalent set of assumptions leading to equation (6a): wage changes are fully reflected in prices. Any trade-off that exists must therefore be due to an asymmetry: price changes are not fully reflected in wages,  $\alpha_{21} < 1$ . By the same token, the source of inflationary bias in the economy is the labor market rather than the product market. By inflationary bias I mean the fact that modern industrial economies regularly experience inflation even at high and socially unacceptable rates of unemployment and under-utilization. This bias cannot be attributed to product pricing, which apparently passes on proportionately changes

in labor costs. In general these are passed in both directions, down as well as up.

This conclusion is at odds with the belief, widespread in the profession and in the public at large, that industrial concentration, monopoly and oligopoly in product markets, is a major culprit. Non-competitive market structure may, or may not, be responsible for excessive mark-ups. (Hirsch indeed detects a slight downward trend in mark-ups.) Nor does it seem to contribute a ratchet effect, with mark-ups rising in prosperous sectors and prosperous phases of the business cycle and failing to decline in depressed sectors and in recessions.

There may, however, be a more subtle and indirect sense in which industrial concentration is responsible for inflationary bias. Perhaps the pricing behavior of a modern economy is the shelter for the wage behavior that appears to be the proximate source. If the competitive model found by Eckstein and Wyss in seven industries applied generally, prices would be so sensitive to demand that utilization would be quite stable. In that case, perhaps wages would be very flexible also. In agriculture, for example, wages are very largely the earnings of self-employed and necessarily move with prices. The features of the labor market that contribute to asymmetry in the relation of money wages to labor demand -- stickiness in the face of low demand, responsiveness to high demand -- may be the inevitable byproduct of the market organization of modern industry. The papers of the conference do not address such fundamental structural issues.



### The Wage Adjustment Equation

Wage Phillips curves of the general form of (2) were presented for three econometric models, for the FMP model by de Menil and Enzler, for the DHL model by Hymans, for the OBE model by Hirsch. These wage equations did remarkably well in tracking recent wage experience through 1969. Their success was the more remarkable because the simulations covered several quarters beyond the period of fit. It is doubtful, however, that the model equations would do as well for 1970 and for 1971, when they would translate the rise in unemployment rates into a moderation of wage inflation not yet observed.

Their most important empirical finding is that  $\alpha_{21}$ , the coefficient of feedback of price inflation on to wages, is significantly less than 1. The estimate ranges from .42 in the DHL (Michigan) model to .77 in the OBE model. This implies that a long-run Phillips trade-off does exist. The asymptotic Phillips curve (6) or (6a) is a lot steeper than the short-run trade-off, but it is not vertical.

The model suggests that cycles in the rate of unemployment will produce clockwise hysteresis loops around the long-run Phillips curve. Thus the decline in unemployment 1965-1969, starting from a history of virtually stable prices and price expectations, produced its full quantum of inflation only with a lag. Likewise the rise of unemployment 1970-71 inherited inflationary expectations from the previous boom, so that inflation remains above its long-run values

for the prevailing rates of unemployment. The prognosis is optimistic -- the inflation will taper off even while the unemployment rate is once again declining. Indeed the models imply a permanent rate of inflation of about . . . percent at 4 percent unemployment, no higher than actual inflation at higher unemployment rates in 1970. The simulations also suggest that nothing permanent, and little temporary, can be gained on the inflation front by slow rather than rapid restoration of full employment.

Before we take too much consolation or comfort from these conclusions, we must remember that the econometric estimates of the trade-off are more pessimistic than statistical Phillips curves estimated before 1966. The addition of four or five years of observation has raised the feedback coefficient by perhaps .20; and the long-run rate of inflation for 4% unemployment by perhaps .02 . We certainly cannot be confident that a conference three or four years from now will not record further pessimistic revisions in our estimates. The 1966-70 experience is historically unique. Perhaps our econometricians are right to regard the observations of this recent period as generated by the same structure as previous observations, with our estimates of the Phillips curve improved by data in a new range. But it is also possible that the whole structure has changed, and is still changing, adversely, and that the optimism of the current estimates is a misplaced residuum of observations from a more distant and benign past. It is too early to tell.

### The Natural Rate Hypothesis

An adherent of the "natural rate" hypothesis would challenge the "long-run" econometric trade-off curves on the ground that a feedback coefficient less than unity reflects irrational "money illusion" which cannot persist in the long run. Pragmatists could dodge the challenge, accepting the principle but arguing that a trade-off exists in as long a run as regularity of structure permits either econometric estimation or practical policymaking. From this standpoint, a more meaningful question is whether the estimated feedback would be greater if enough lagged price terms were used. The equations at hand might have used more, but they are not alone in their conclusion. As Nordhaus reports, virtually all empirical feedback estimates are less than one. This is true even when equation (3) takes the form

$$\dot{g}_p^e = \beta(g_p - g_p^e) ,$$

implying that  $g_p^e$  depends on all past values of  $g_p$  with exponentially diminishing weights.

A vertical long-run Phillips curve is built into the St. Louis Federal Reserve Bank monetarist model, the basis for the conference paper by Anderson and Carlson. The natural rate of unemployment is assumed, perhaps optimistically, to be 4 percent. The wage-price block of the St. Louis model diverges from the other models in taking price inflation and unemployment to be jointly dependent on aggregate demand variables -- money GNP and the Okun gap between potential and

actual real output. In the other models aggregate real demand determines unemployment, which can be taken as the semiexogenous variable for the wage-price subsystem. (This is not quite true in the long run. The rate of productivity advance may depend upon the composition of output and therefore on the mixture of monetary and fiscal policy, and equation (6) or (6a) says that the rate of inflation will depend on  $Y$  as well as on  $u^*$ . Hirsch reports an effect of this kind in simulations of the OBE model.)

The St. Louis procedure may be preferable to the usual practice. The two would be equivalent if Okun's law always held exactly, but it does not and conceivably the market pressures that move prices and wages are better related to the gap than to actual unemployment.

Although the Anderson-Carlson simulations are based on a "monetarist" model, the distinctive controversial feature of the model -- the equation explaining money GNP by the money stock -- need not engage us here. Their inflation simulations can be interpreted as describing the consequences of alternative growth rates of money GNP, whether these would be generated by the money stock, as Anderson and Carlson believe, or in some other way. After all, one does not have to accept monetarist doctrine, in the sense that money is all that matters for the course of nominal GNP, in order to accept the natural rate hypothesis. (Nor do monetarists necessarily have to accept that hypothesis; some items of scripture are separable.)

The Anderson-Carlson simulations are instructive, especially for the natural rate exponents who today advocate deflationary aggregate

demand policy. These exponents point out that the economy can return to its natural unemployment rate at any rate of inflation, and suggest therefore that we might as well take the extra time needed to make the permanent inflation rate close to zero. A policy of expanding nominal income at its long-run non-inflationary rate would, according to Anderson and Carlson, keep the economy above 6% unemployment until 1976. In contrast, a policy ultimately consistent with 2-1/2 percent inflation would never entail inflation above 6% and would reduce unemployment below 5% in 1975. The contrast may not be a Phillips trade-off, but it is certainly a trade-off relevant for policymakers.

Robert Lucas, in an outstanding original theoretical paper at the conference, presents a different challenge to the significance of findings that the feedback coefficient is less than unity. He models a world in which econometricians would surely enough find this result but in which there would nevertheless be no durable trade-off on which policymakers could rely. In the Lucas model individual firms and businessmen do not have complete information about the prices of the things they buy and sell. They decide on quantities on the basis of the best probabilistic price estimates they can make, conditional on the information they do have. Aggregate money demand is subject to random errors about its systematic predictable trend. When the error is positive individuals underestimate the unknown prices of the things they buy, and over-produce

or over-supply labor in response to apparently favorable prices of what they sell. Under-production and under-employment occur when the random error in aggregate money demand is negative. A history of deviations of this kind will provide the statistical appearance of a trade-off. But the appearance is deceptive. The deviations in aggregate demand that produce it must necessarily be random surprises. If the government systematically steps up aggregate demand to obtain higher employment and production, its policy will be learned and absorbed into the procedures by which citizens estimate the prices they do not directly observe.

Interestingly enough, one of Lucas's precursors was J. M. Keynes: "For a time at least, rising prices may delude entrepreneurs into increasing employment beyond the level which maximizes their individual profits measured in terms of the product. For they are so accustomed to regard rising sale-proceeds in terms of money as a signal for expanding production, that they may continue to do so when this policy has in fact ceased to be to their best advantage; i.e., they may under-estimate their marginal user cost in the new price environment." (General Theory, p. 290.)

Lucas's paper is a rigorous defense of the natural rate hypothesis, and its rigor and sophistication have the virtue of making clear what the hypothesis requires. The structure of the economy, including the rules guiding fiscal and monetary policy, must be stable and must be understood by all participants. The participants

must not only receive the correct information about the structure, they must use all of it correctly in estimating prices and making quantitative decisions. They must be better econometricians than any of us at the conference. If they are, they will always be -- except for the unavoidable mistakes due to purely random elements in the time sequence of aggregate money demand -- at their utility- and profit-maximizing real positions. These positions are invariant to any systematic changes in the sequence of aggregate money demand, either in its level or in any of its time derivatives.

Once again, a pragmatist might conclude that he agrees with the natural rate hypothesis in principle but also believes that, in as long a run as can be of concern to policymakers in an uncertain and changing world, a trade-off does exist for policymakers as well as for statisticians.

#### Price Expectations

As the preceding review makes clear, inflation expectations play a crucial role in the theory and estimation of trade-off equations. The almost invariable practice in estimation is to represent inflation expectations by some weighted average of past actual rates of inflation. Our research is certainly vulnerable at this point. On the one hand, the lagged variables may show statistically significant effects for reasons quite remote from their putative influence on expectations. And on the other hand, they are almost surely inaccurate gauges of expectations. Consumers, workers, and businessmen may not be as good econometricians as Lucas would have

them, but they do read newspapers and they do know better than to base price expectations on simple extrapolation of price series alone.

Empirical data on price expectations do exist. They may be incomplete, but they are evidence, and it is no credit to econometric studies of the wage-price nexus that they are ignored. George Katona and company have collected price expectation data from consumer surveys since 1946. They show that people learn from experience but do not follow any simple extrapolative model.

The long-term trend of expectations in the Michigan surveys is certainly one of increasing acceptance of creeping inflation. In 1949 only 8 percent of respondents expected general price increases during the coming year. In 1969 this number was 75 percent. But the public has been quite sensitive to economic and political events they associate with inflation. The Korean war caused a big bulge -- 77 percent expected inflation at the beginning of 1951, 53 percent in 1952; in the recession that followed, consumers returned substantially to their pre-Korean views. The military and economic escalation of the Vietnam War in 1966 produced another bulge. Subsequent expectation seem to reflect quite promptly -- more faithfully than actual price behavior -- fluctuations in the economic situation and in government policy.

The extrapolation model, after all, does not really make sense. Price movements observed and experienced do not necessarily convey information on the basis of which a rational man should alter his



view of the future. When a blight destroys half the midwestern corn crop and corn prices rise, the information conveyed is that blights raise prices. No trader or farmer in his right mind would change his view of the future of corn prices, much less of their rate of change, unless he is led to reconsider his estimate of the likelihood of blights. When in 1950 the fear that the invasion of Korea would lead to a full scale war touched off a frenzy of speculative buying, no rational person would give the resulting inflation a positive weight in calculating the future. On the other hand, if recent experience leads the public, as well as professional economists to conclude that the Phillips curve is worse than they thought, they are correct to build this bad news into their future calculations.

The St. Louis monetarist model, on which the Anderson-Carlson conference paper is based, includes a more sophisticated mechanism for generation of price expectations than other econometric work, at least any other work reported at the conference. Anticipated price change depends not only on price history, but on past values of other macro-economic variables, total spending and unemployment. The idea is admirable, but its execution is puzzling. Why should an observed price increase get twice as much weight in the formation of expectations if it occurred when unemployment was 3% as if it occurred when unemployment was 6%? Perhaps it should if it is low relative to what might be considered normal at 3% unemployment, because then it conveys new information. But the reverse would be true for a price increase of a magnitude that would be surprising at 6% but normal at 3%.

Concluding Comment

The conference was timely and constructive. The empirical work on wages and prices is impressive and promising. Our ignorance and uncertainty are still vast, but the conference papers constitute a solid foundation on which to build future research. The generalist of my opening paragraph might well conclude and report that there is more reason to be optimistic about wage-price econometrics than about resolution of the inflation-unemployment dilemma.

I have concentrated on the central themes and messages of the conference, and in so doing I have slighted some papers and parts of papers which were tangential. These include interesting aspects of the FMP and OBE econometric models beyond the wage-price sector; the ambitious disaggregated BLS model of the Heien-Popkin paper, noteworthy for its attempt to wed econometrics with analytical rigor; Geoffrey Moore's important statement about the statistical program of the BLS; and Nerlove's pioneering calculations of the spectral densities of time series of prices, whose significance I do not yet really grasp. I hope that it will be understood that my selectivity reflects no judgments of quality or importance but only the macro-economic policy bias I avowed at the outset.